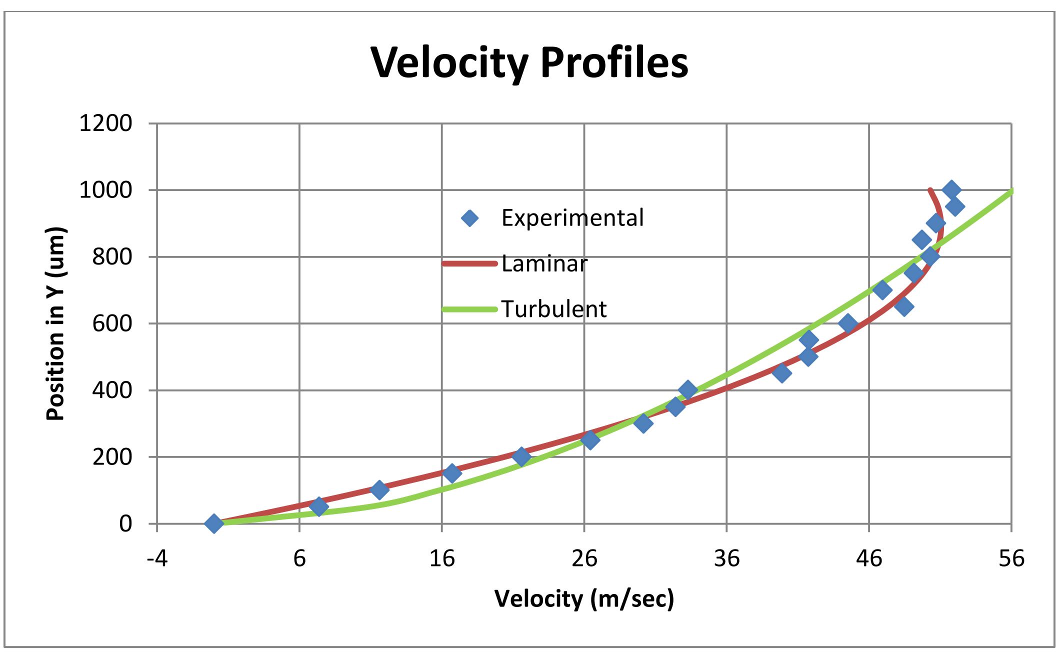
Homework #7: Fluid Boundary Layer Velocity Profiles

Excel Solution: The least variance squared value was used to find the best fit curve to the data given the experimental data and necessary equations. The laminar flow in the excel case was the best fit and in the shape of a parabola with a squared variance of ~40. The turbulent flow in the excel case is more of an exponential line with a squared variance ~129. The graph was formed with the position on the y axis and the velocity on the x axis to show the velocity profile.

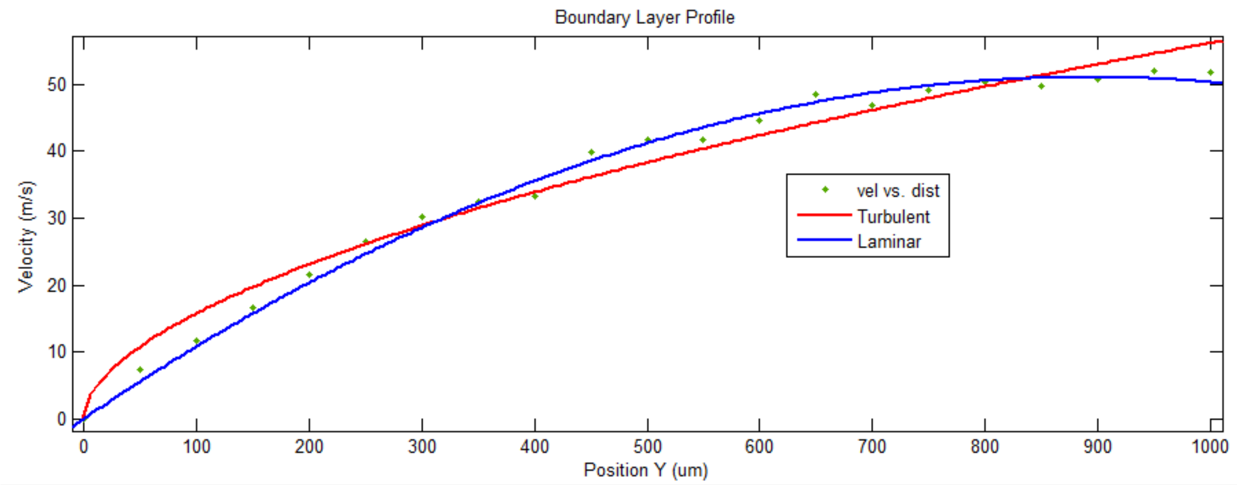
Velocities Experimental vs Theoretical					
Experimental	Laminar	Turbulent	Distance	Laminar	Turbulent
v (m/sec)	v (m/sec)	v (m/sec)	y (um)	Variance^2	Variance^2
51.8	= UL*(2*($E24/DL)-($E24/DL)^2)	= UT*($E24/DT)^(1/NT)	1000	=($B24-$C24)^2	=($B24-$D24)^2
		Sum Variance^2		=SUM(F4:F24)	=SUM(G4:G24)

Velocities Experimental vs Theoretical					
Experimental	Laminar	Turbulent	Distance	Laminar	Turbulent
v (m/sec)	v (m/sec)	v (m/sec)	y (um)	Variance^2	Variance^2
51.80	50.2938629	56.144516	1000	2.268448889	18.8748208
		Sum Variance^2		33.99168878	128.734317

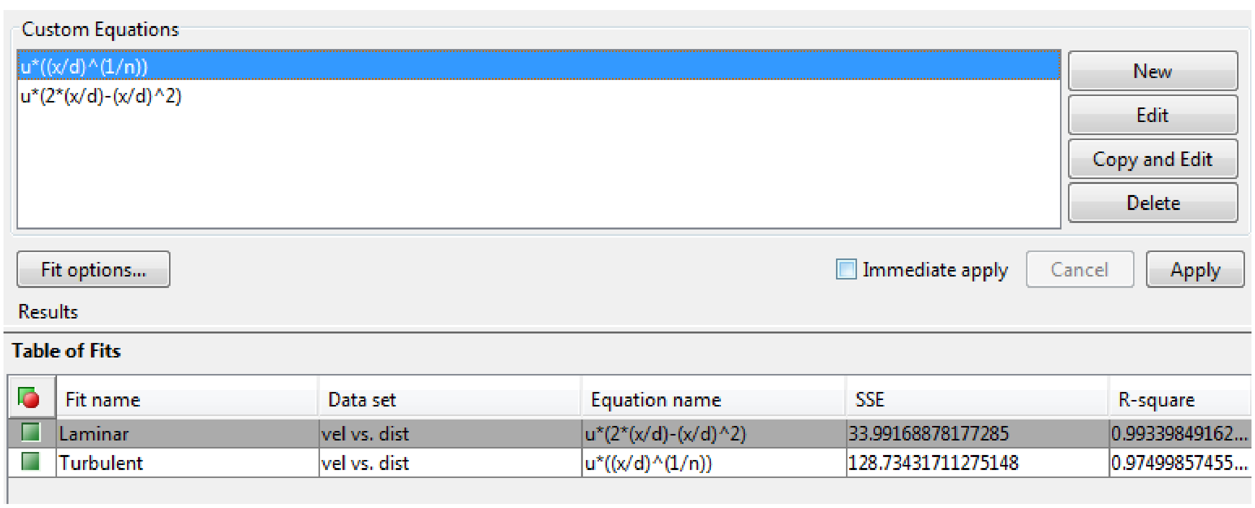
Laminar		
U	N	Delta
51.05897		890.9384
Turbulent		
U	N	Delta
52.97356	1.81421859	899.9002



Matlab Solution: The cftool was used in matlab to find the best fit curves for the boundary layer profile. The laminar case in the matlab solution appears to the best fit and has the better squared variance value of ~40 instead of ~129 and these values max those in the Excel case. The data and fit curves were plotted with the velocity versus the position to show the boundary layer profile.



Laminar		
U	N	Delta
51.06		890.9
Turbulent		
U	N	Delta
51.78	1.814	863.3



Fit name	Data set	Equation name	SSE	R-square
Laminar	vel vs. dist	u*(2*(x/d)-(x/d)^2)	33.99168878177285	0.99339849162...
Turbulent	vel vs. dist	u*((x/d)^(1/n))	128.73431711275148	0.97499857455...